International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(5): 1663-1672

Received: 07-07-2020
Accepted: 09-08-2020

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Study of physico-chemical properties of mosambi jelly

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DOI: https://doi.org/10.22271/chemi.2020.v8.i5w.10537

Abstract
This study was designed to develop the mosambi fruit jelly and also determined the physico-chemical properties. Three mosambi fruit jelly samples such as T1, T2 and T3 were developed and subjected for sensory evaluation. Best sample was selected and all samples were analyzed for physico-chemical properties. Results showed that the sample T3 got highest score for overall acceptability (8.22±0.64) compared to sample T1 and T2. Mechanical properties such as cohesiveness, gumminess, hardness, springiness and chewiness for three samples were assessed out of which gumminess and cohesiveness were highest for T3 with values 1889 and 0.81 respectively. Samples were also assessed for chemical analysis such as carbohydrates, reducing sugars, protein, vitamin C and scavenging activity and compared with that of mosambi juice. Vitamin C and scavenging activity were low for T3 i.e., 6.22% and 16.36% respectively when compared to mosambi juice which has vitamin C and scavenging activity of 62% and 95.75% respectively. Moisture content, p^H, titrable acidity, ash, TSS were also assessed for three samples. Moisture content, p^H were highest for T1 i.e., 35.16% and 3.5 respectively. Ash, TSS, titrable acidity were highest for T3 i.e., 99.79%, 76^0 Brix and 0.81 respectively.

Keywords: Mosambi juice, mosambi jelly

1. Introduction
Jelly is a semi-solid product prepared by boiling a clear, strained solution of pectin- containing fruit extract, free from pulp, after the addition of sugar and acid. A perfect jelly should be transparent, well-set, but not too stiff. Jelly should not be gummy, sticky, or syrupy or have crystallized sugar. Jelly should taste fresh and fruity.

Mosambi is also known as sweet lime in the Indian subcontinent region. It is native to Asia and best cultivated in India, China, Southern Japan, Vietnam, Malaysia, Indonesia and Thailand. All parts of the mosambi plant can be used as a traditional medicine and also it does not have any toxicity and adverse effects of any part of plant. It was reported that it has some pharmacological activities like antibacterial, antifungal activity, antioxidant activity anti-hyperglycemic activity and antitumor potential (Ahmed Abdullah Khan *et al*., 2016) [1].

Susana Rubio Arraez *et al*. (2016) [18] studied on physio-chemical properties of citrus jelly with non-carcinogenic and functional sweetners. Soluble solids, moisture content, p^H, water activity, anti-oxidant, optical and mechanical properties of the jelly were determined. Mechanical properties of samples were evaluated with texture profile analysis test (TPA) using a texture analyser.

Ahmed Abdullah Khan *et al*. (2016) [1] carries studies on phytochemical and pharmacological properties on citrus limetta (mosambi). It includes that nearly all parts of plant can be used as a traditional medicine and also it does not have any toxicity and adverse effects of any part of plant. It was reported that it has some pharmacological activities like antibacterial, antifungal activity, antioxidant activity anti-hyperglycemic activity and antitumor potential.

Andres Alejandro Damian Reyna *et al*. (2017) [2] conducted studies on polyphenolic content and bacterial effect of Mexican citrus limetta and citrus reticulate. Reported that citrus limetta and citrus reticulate shows an important content of phenolics and flavonoids which makes them potential sources of polyphenolic compounds. The extracts of *C.reticulate and C.limetta* were found to show antimicrobial activity.

Awadhesh Kumar and Bhagwan Deen *et al*. (2017) [3] studies on preparation and shelf life of jelly from wood apple (*Limonia acidissima* L.) fruits. Three different formulations of jelly from wood apple fruit were prepared under subjected for determination of TSS, ascorbic acid, titrable acidity, sugars, organoleptic quality and microbial growth by standard plate count method for four months. It was concluded that development of jelly with 75% water and 25% mature fruit pulp was found to be best during oraganoleptic quality.

Bhavana soni *et al*. (2013) [4] conducted microbial analysis in estimation of microbial population in some confectionary products like jam, jelly, biscuits. By analyzing four confectionary products jelly shows less contamination than others where as biscuits (parle G) shows more contamination.

Chaudhari and Nikam (2013) [5] conducted studies on development and sensory analysis of beetroot jelly. Three variations of beetroot jelly were prepared and subjected for sensory analysis .By using 9 point hedonic scale by a panel of 10 trained members. The beetroot jelly was developed with standard formulations using 2% pectin 0.5% citric acid and 61% sugar scored highest in sensory evaluation (8.3) for overall acceptability.

In light of the aforementioned facts, this study was, therefore, undertaken to: (1) develop and standardize the mosambi jelly (2) Determine the physico-chemical properties of mosambi jelly.

2. Materials and Methods

2.1. Raw materials and chemicals

All the raw materials such as mosambi, sugar, citric acid, pectin were purchased from a local market (Pulivendula, India). All chemicals used in the research were of analytical grade and purchased from HiMedia Laboratories Pvt. Ltd. (Mumbai, India).

2.2 Physico-chemical characteristics

Physico-chemical characteristics of the samples were determined by using standard AOAC methods**.**

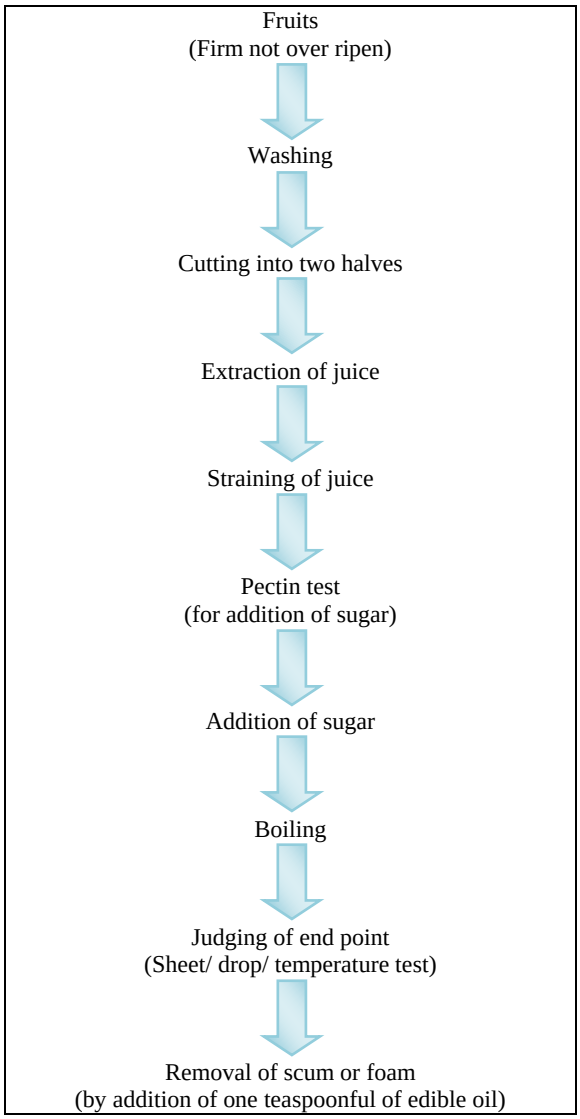
2.3 Formulation of Mosambi Jelly

Different jellies were made using mosambi juice in different proportions of sugar and pectin.

Table 1: Different formulations for preparation of jelly from mosambi juice

Samples	Juice	Sugar	Pectin	Citric acid
T1	500 ml	250 g	5 g	0.5 g
T2	500 ml	260 g	7.5 g	0.5 g
T3	500 ml	270 g	10 g	0.5 g

2.4 Flow Chart for Preparation of Jelly



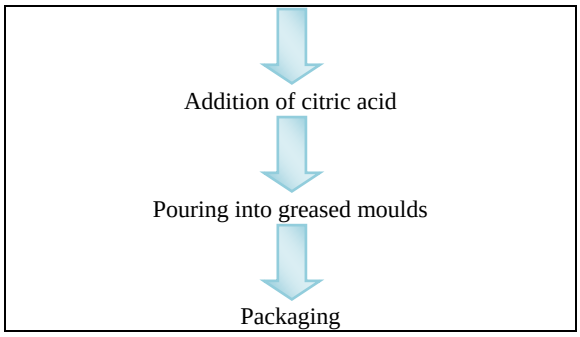


Fig 1: Flow chart for preparation of mosambi jelly

2.5 Organoleptic Evaluation of Mosambi Jelly

Organoleptic evaluation of mosambi jelly was carried out by using 9 point hedonic scale. Samples were tested for various sensory parameters such as flavor, appearance, taste, texture, and overall acceptability (Chaudhari and Nikam, 2013) [5].

3. Results and Discussion

3.1 Organoleptic Evaluation

Organoleptic evaluation was done for all samples by using 9 point hedonic scale method.

3.1 Organoleptic evaluation of mosambi jelly

Parameters	T1	T2	T3
Appearance	7.38±1.14	7.66±0.90	7.777±0.87
Flavor	7.05±1.11	7.38±0.97	7.77±0.94
Taste	6.61±1.53	7.72±0.89	8.11±0.75
Texture	7.11±0.90	7.50±0.78	8.05±0.87
Overall acceptability	7.33±0.97	7.66±0.68	8.22±0.64

Values were expressed as mean ± standard deviation

3.2 Physico-Chemical Parameters

Table 2: Physico-chemical parameters of T1, T2 and T3

S. No	Parameters	T1	T2	T3
1	Ash	96.721%	99.11%	99.796%
2	p^H	3.5	3.7	3.4
3	TSS	66^0 B	68^0 B	70^0 B
4	Brix / acid ratio	134.69	102.874	86.3557
5	Acidity	0.49	0.661	0.8106
6	Moisture	34.286	35.16	34.786

3.2.1 Ash

Ash analysis was done by using AOAC method and the percentage of ash obtained for Sample111-T1, sample112-T2 and Sample113-T3 are 96.721%, 99.11% and 99.796% respectively.

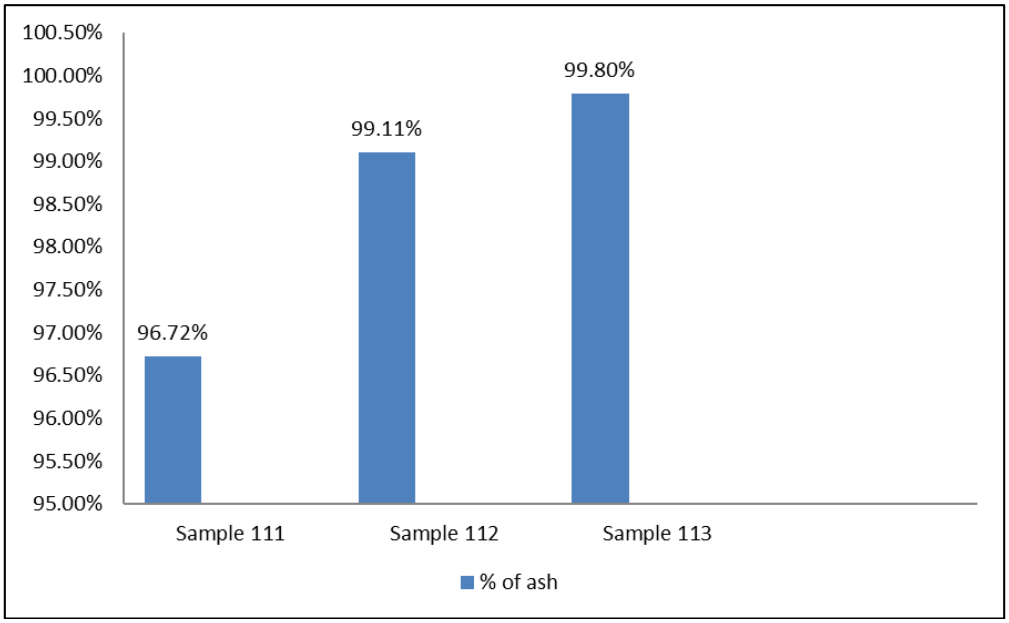


Fig 2: Graph showing ash analysis of mosambi jelly

3.2.2 P^H values

P^H value of different jelly samples were determined by using p^H meter. P^H value for T1-T1, T2- T2, and T3-T3 were 3.5, 3.7, and 3.4 respectively. From the above observation p^H for T2 was highest and for T3 was found to be lower.

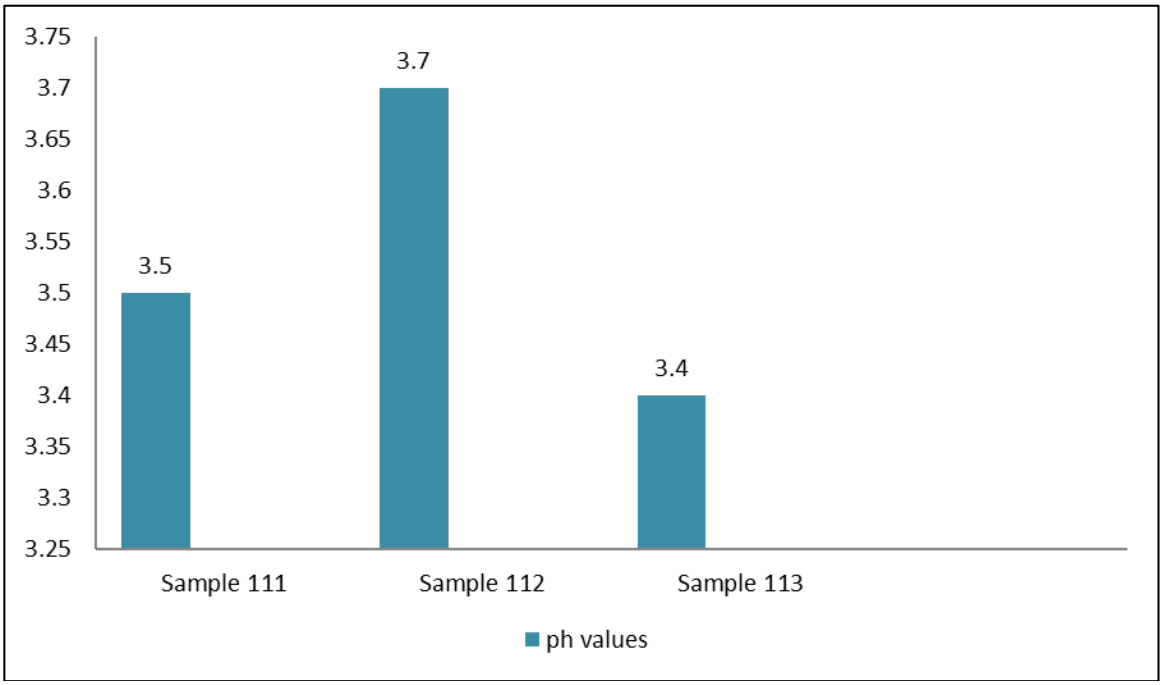


Fig 3: Graph showing p^H values of mosambi jelly

p^H of mosambi jelly is high when compared to p^H of pomegranate jelly which has p^H of 3.2.

3.2.3 TSS values

TSS values of different jelly samples were determined by using refractometer. TSS values for T1, T2, T3 were 66°B, 68°B, 70°B respectively. From the above observation TSS for T3 was highest and for T1 was found to be lower.

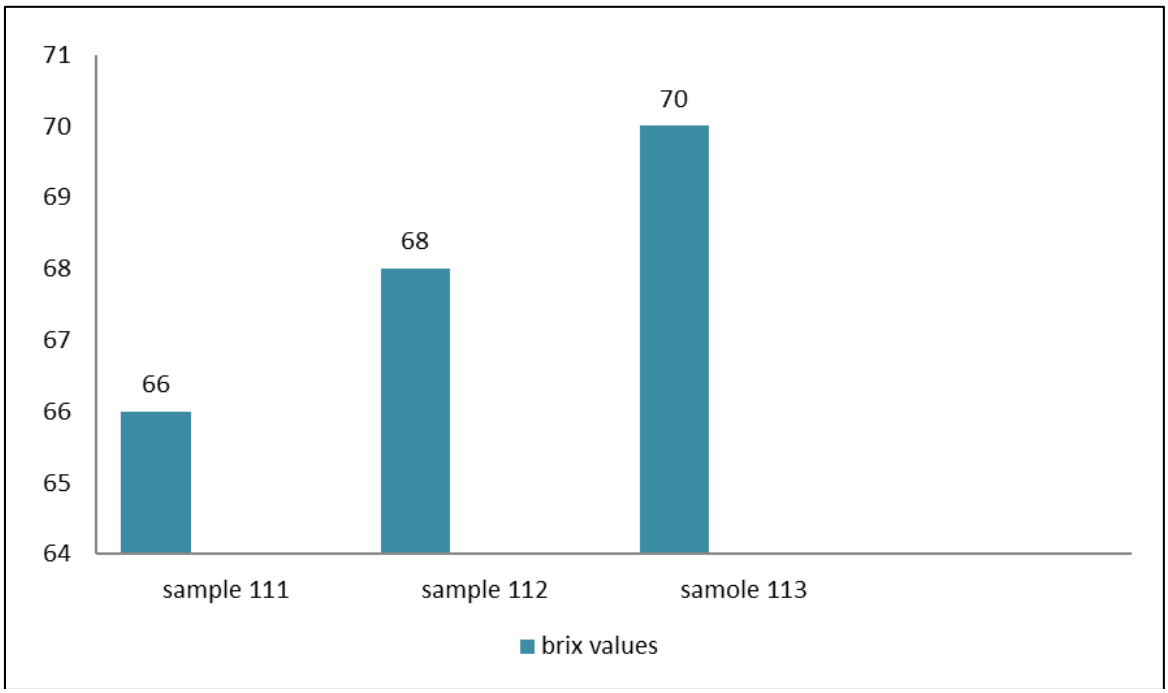


Fig 4: Graph showing TSS values of mosambi jelly

TSS of T1 has 66^0 B and is observed to has same TSS range of dragon fruit jelly

3.2.4 Brix/acid ratio

Brix/ acid ratio values of different jelly samples were determined by using brix and acidity values. Brix/acid ratio values for T1, T2, and T3 were 134.69, 102.874, and 86.3557 respectively. From the above observation brix/acid ratio for T1 was highest and for T3 was found to be lower.

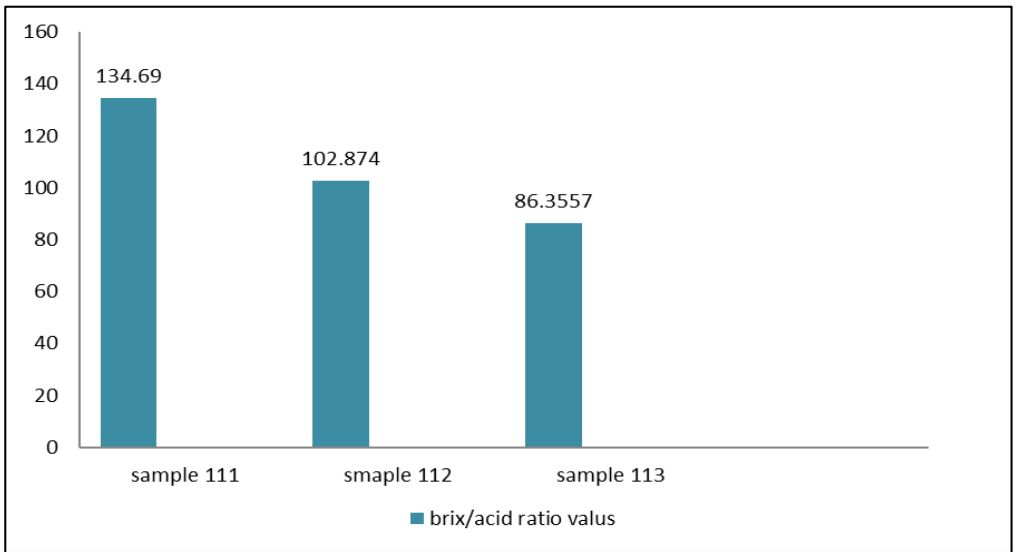


Fig 5: Graph showing Brix/ acid values of mosambi jelly

3.2.5 Titrable Acidity values

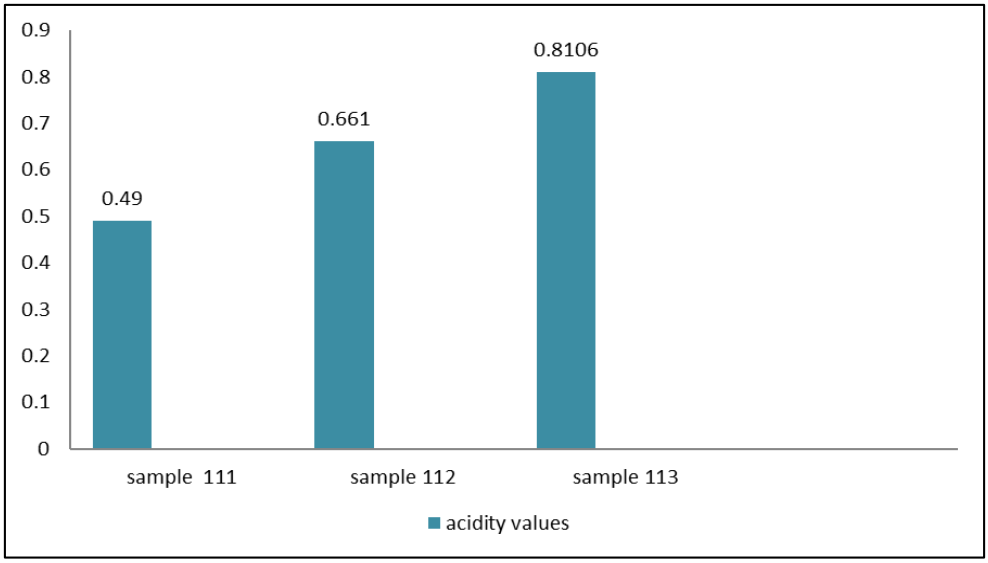


Fig 6: Graph showing the titrable acidity values of mosambi jelly

3.2.6 Moisture content:

Moisture content values of different jelly samples were determined by using hot air oven. Moisture values for T1, T2, and T3 were 34.286, 35.16, and 34.786 respectively. From the above observation moisture value for T3 was highest and for T1 was found to be lower.

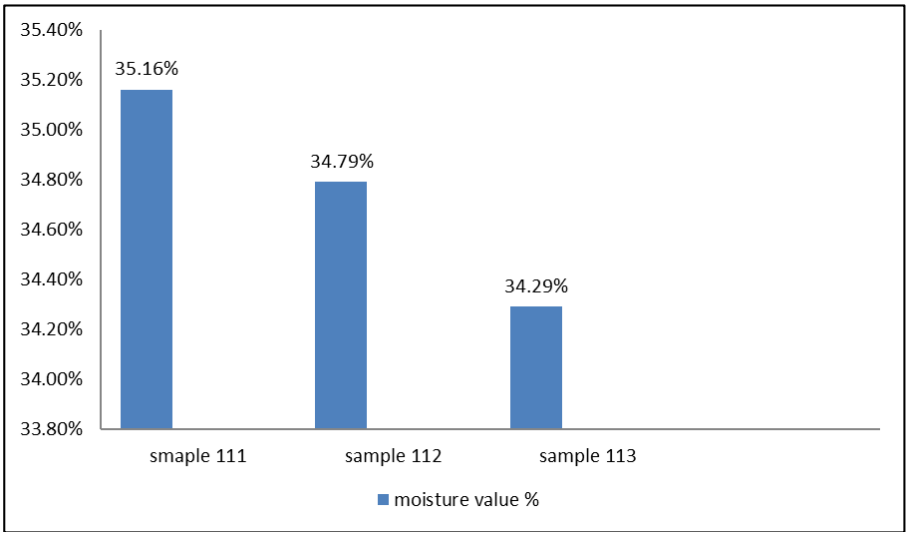


Fig 7: Graph showing the moisture values of mosambi jelly (Sample 111-T1, sample112 –T2 sample 113-T3)

3.3 Nutritional Composition of Mosambi Jelly

Table 3: Nutritional composition of mosambi jelly

Parameters	Juice	T1	T2	T3
Carbohydrates (%)	12.98%	52%	64%	74%
Reducing Sugars (%)	12.8%	15.92%	16.32%	16.54%
Protein	1.25%	0.78%	0.78%	0.78%
β- carotene (%)	0.396%	0.0496%	0.0496%	0.0496%
Vitamin C (%)	62%	14.22%	8%	6.22%
Scavenging activity (%)	95.75%	38.86%	37.27%	16.36%

3.3.1 Carbohydrates

The analysis of carbohydrates done by phenol sulphuric acid method in fresh juice, T1, T2, and T3. The results are 12.98%, 52%, 64%, and 74% respectively. From the above observation, T3 has high percentage of carbohydrates when compared to T1 and T3.

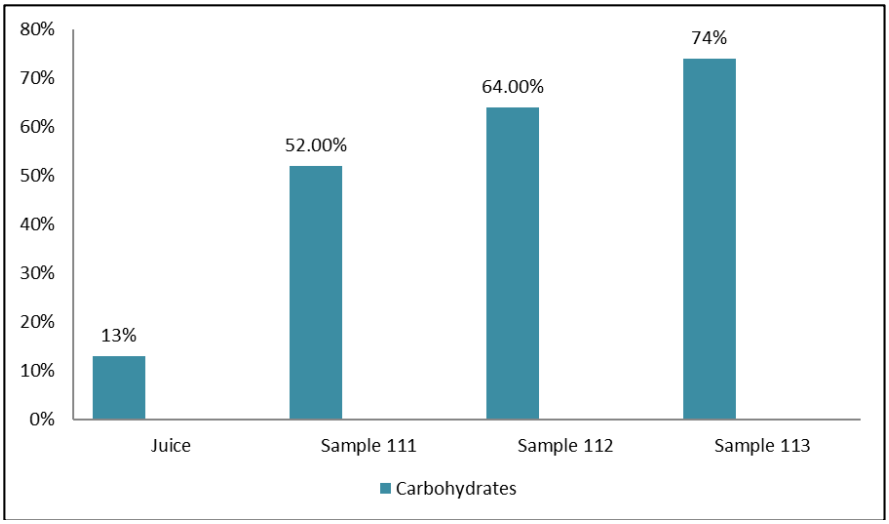


Fig 8: Graph showing% of carbohydrates in mosambi jelly

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3.3.2 Reducing Sugars

Reducing sugars in fresh juice, T1, T2, and T3 are analyzed by using AOAC method. From above observation% reducing sugars in fresh juice, T1, sample112, and T3 are found to be 12.8%, 16.317%, 11.668%, and 15.922% respectively.

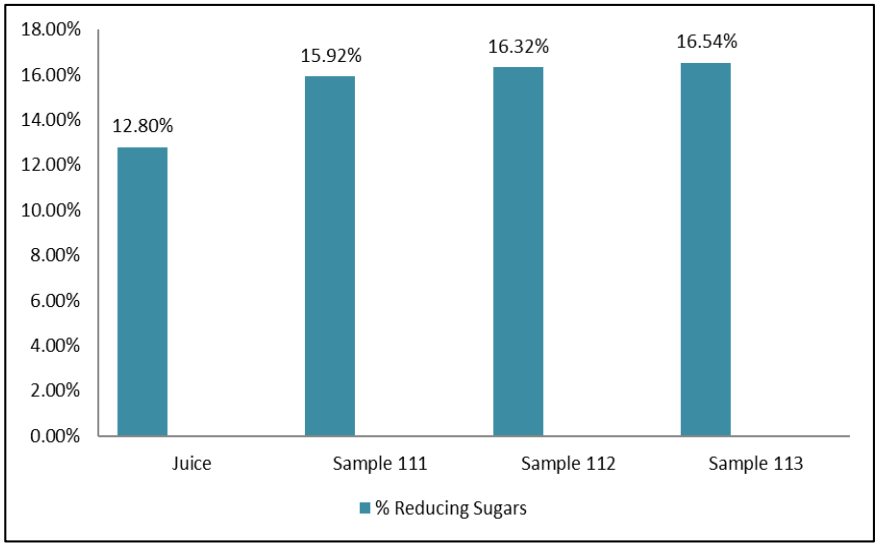

Fig 9: Graph showing% of reducing sugars in mosambi jelly

3.3.3 Proteins

Proteins composition in fresh juice, T1, T2 and T3 are analyzed by using Folin lowry method. From above observation protein content in fresh juice, T1, T2 and T3 are 1.25%, 0.78%, 0.78% and 0.78% respectively.

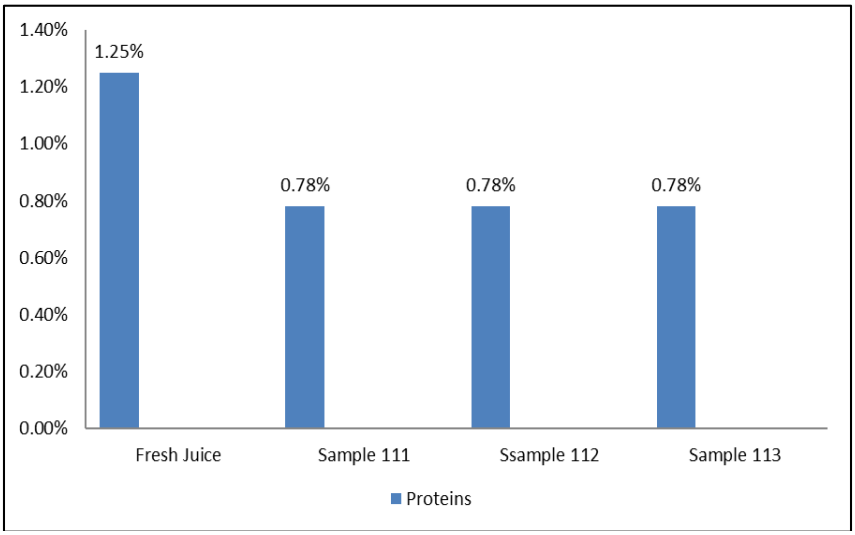

Fig 10: Graph of protein content of mosambi jelly

3.3.4 Vitamin C

Vitamin C composition in fresh juice, T1, T2 and T3 are analyzed by using AOAC method. From above observation Vitamin C content in fresh juice, T1, T2, T3 are 62%, 14.22%, 8% and 6.22% respectively.

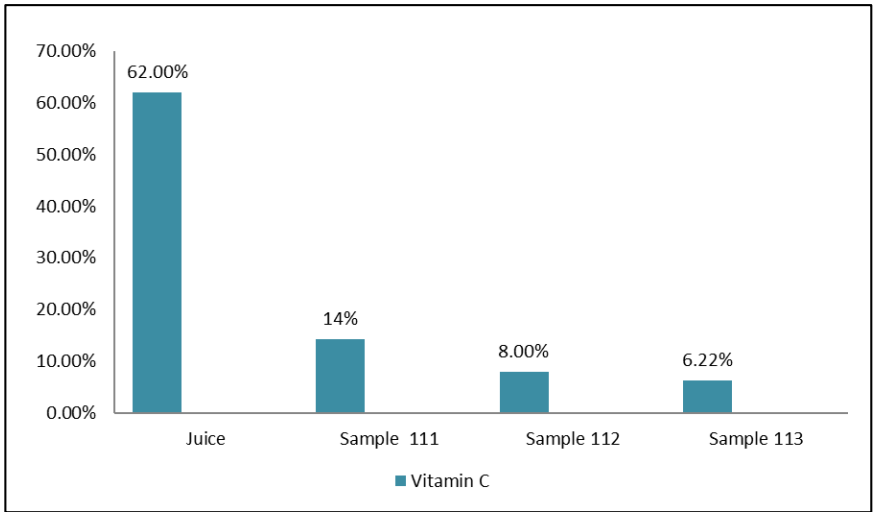

Fig 11: Graph showing% of vitamin C in mosambi jelly

3.3.5 β – Carotene

β- Carotene in fresh juice, T1, T2 and T3 are analyzed. The results of β – Carotene in fresh juice, T1, T2 and T3 are 0.396, 0.0496, 0.0496 and 0.0496 respectively.

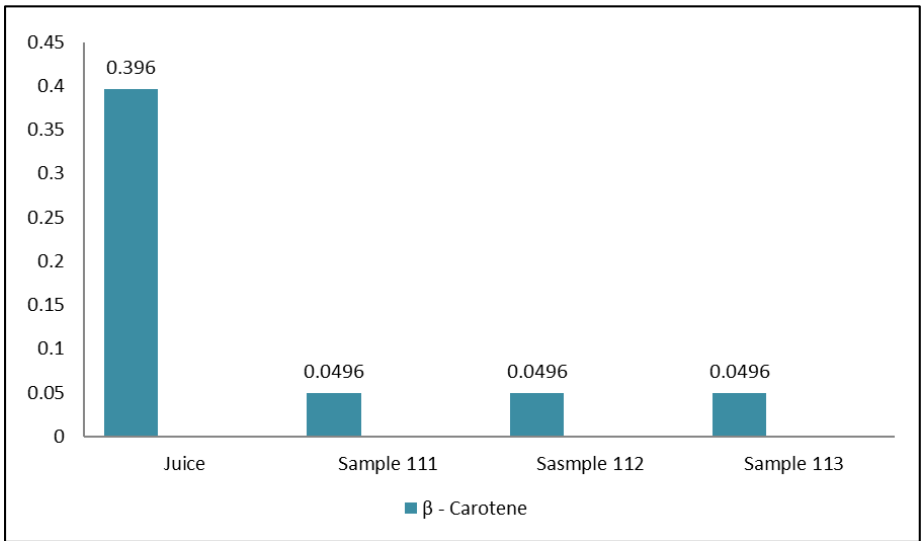

Fig 12: Graph of β- carotene of mosambi jelly

3.3.6 Antioxidant

Antioxidant acivity of Juice and samples of mosambi jelly are analysed by using DPPH method. The antioxidant activity of juice and mosambi jelly are as shown in the following graph.

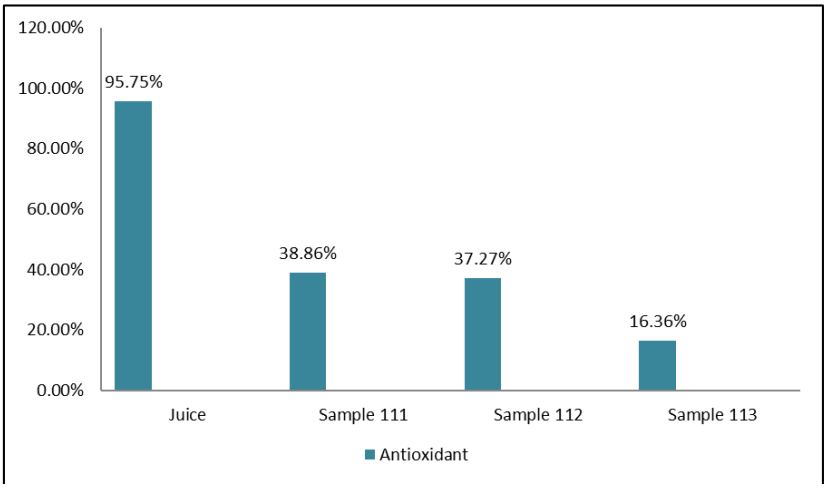

Fig 13: Graph showing scavenging activity of juice and mosambi jelly

3.4 Mechanical Properties

Mechanical properties of mosambi jelly like hardness, cohesiveness, gumminess, springiness and chewiness are determined by using Brookfield Texture Analyser.

Table 4: Mechanical properties of mosambi jelly

Parameters	T1	T2	T3
Hardness	2480 g	4060 g	2320 g
Cohesiveness	0.54	0.40	0.81
Gumminess	1336 g	1630 g	1889
Springiness	2.08	3.53 mm	1.60 mm
Chewiness	27.3mJ	56.4 mJ	29.6 mJ

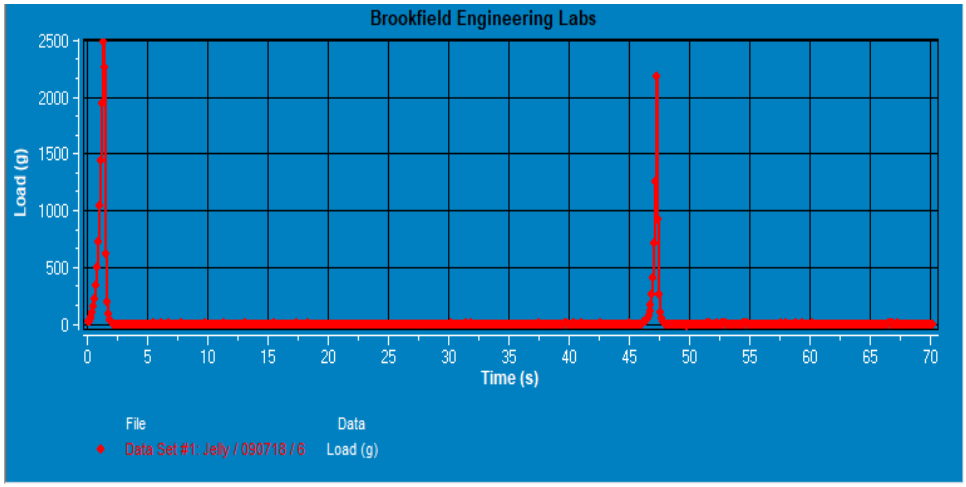

Fig 14: Resultant graph for texture analysis of T1

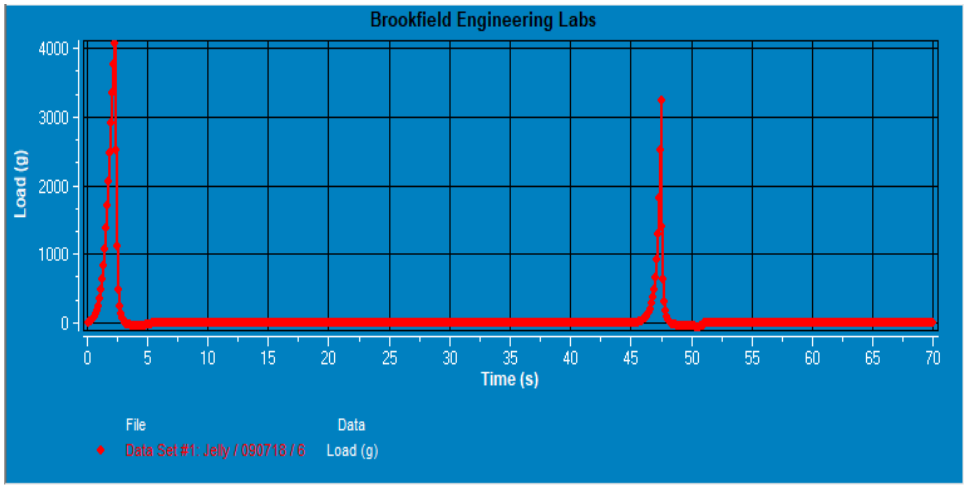

Fig 15: Resultant graph for texture analysis of T2

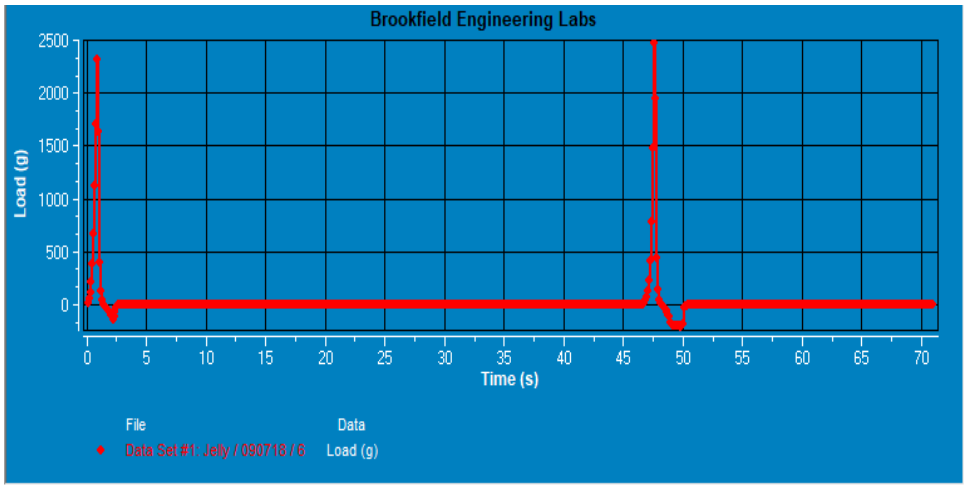

Fig 16: Resultant graph for texture analysis of T3

3.5 Optcal Properties

Color

Color of mosambi jellies are determined by using Hunter Lab Color Flex Spectrometer. The Values of L, a, and b for T1, T2, and T3 are as follows.

Table 5: Color parameters of T1, T2, T3.

Color Parameter	T1	T2	T3
L	26.75	31.223	23.903
A	6.106	2.22	0.27
B	11.843	33.216	10.733

From above observation, T3 having great L value is more close to black when compared to T1 and T2. All samples have positive values and all samples have positive b values.

4. Conclusion

Mosambi juice can be used as a raw material for the preparation of jelly. From the above studies, it was concluded that a good quality value added product can be prepared from mosambi juice. According to sensory analysis T3 (T3) was best scored sample. According to microbial analysis jelly is microbiologically safe for consumption. The manufacture of mosambi jelly is therefore an alternative use of mosambi fruits**.**

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